little damage was done. Thus everywhere except at West Mersea there are one or more lines, at one side of which there was excessive damage not to be found at the other side.

In the area of excessive damage, according to Mr. Dalton's map, the geological formations are *Alluvium*, *Glacial Drift*, and *London Clay*. On the first we find damage done to houses near Eastbridge, Colchester, and at Wivenhoe, although elsewhere they escaped. In the north portion of Wivenhoe and the north portions of Colchester, structures on the Glacial Drift were injured, but elsewhere the damage nearly invariably is confined to tracts and small exposures of the London Clay. This is very conspicuous in places—at Colchester there is a narrow outcrop of London Clay which widens eastward near the Colne, and on this narrow tract the greatest damage was done; similarly at Wivenhoe the excessive damage is along the outcrop of the London Clay. At Fingrinhoe and Frenchman's Lane the damage margins an outlying tract of Glacial Drift, while very good examples can be seen between Colchester and Ardleigh, the structures on narrow tongues of the clay being injured, while those on the intervening tracts of gravel have escaped, except in one instance.

Victoria Road, Colchester J. HENRY KINAHAN

ONE of the most curious effects of the earthquake in the Peldon district is the evidence of a decided *twist* or apparent rotation of the shock evident in many cases upon standing buildings. Is is very apparent in the cracks throughout Dr. Green's house, which take a complete screw round some of the rooms and the staircase. It is also evident in the twist of the tapering mill chimney shaft where the upper 20 feet (still standing) is screwed round at the fracture upon the lower part about one inch. The same is apparent in a chimney at the "Peldon Rose" Inn, the screwing in this instance being about two inches. As such twists as are evident could not exist within the areas of separate single buildings, it appears to me that they must have been the resultants of the effects of two separate shocks, the first about north to south, and the second immediately following about east to west. That there were two shocks appears to be the general impression of the inhabitants of whom I made inquiry. Another matter of interest is the very peculiar fracture of the eastern side of Dr. Green's house. This fracture leaves the lower northern corner of the wall, and passes diagonally across the house to the upper southern corner. The crack is open about one inch through solid modern brickwork. In this case the line of fracture does not follow a line of weakness in the wall, but cuts directly through the thick chimney breasts, and equally across a window opening, as though there was present no difference in resistance. The angle of fracture is about 47° to the horizon, and it appears to me that this must have been the direction of the first or greater shock in this district, which was therefore more one of upheaval than of horizontal motion. This is also confirmed upon inquiry, as I find many persons in the district felt distinctly the motion of upheaval, but no one who was standing at the time is known to have been thrown down.

W. F. STANLEY

DARWIN relates that the earthquake of February 20, 1835, which overthrew Concepcion, although it was severely felt in Chiloe, yet on the neighbouring Cordillera (near Mellipulli) it was not felt at all. "Some men who had been employed in the mountains splitting fir planks, when they returned in the evening to Calbuco and were told of the shock, said that 'about the time mentioned they recollected that they had not been able to strike fair with the axe, and that they had spoilt a board or two by cutting too deep.' This probably is not so fanciful as it appears; at least it shows that if there was any motion it was of an exceedingly gentle kind" (*Trans. Geol. Soc.*, vol. v. p. 605).

A parallel case occurred during the late earthquake in Essex. Some men hoeing wheat at Frating, about seven miles north-east of the focus of the shock, did not perceive the shock, but felt as if they could not get their hoes to the ground.

May 30 O. FISHER

Jupiter

THIS planet is now so unfavourably placed that very few further opportunities will occur of observing the chief features during the present apparition. It is, however, important that the red spot and equatorial white spot should be followed as long as practicable, and I give a list of the times when they will be situated on or near the central meridian:—

		Red spot h.			White spot h.
June 5	...	8·8	June 5	...	9·1
7	...	10·4	7	...	10·3
10	...	7·9	12	...	8·3
12	...	9·5	14	...	9·5
17	...	8·7	21	...	8·8
22	...	7·8	28	...	8·1

The two spots will come to the same longitude on June 7, but at the time of their transit Jupiter will be too low to admit of satisfactory observation.

Erratum.—The dark satellite transit which I observed on May 18 (NATURE, May 22, p. 77) referred to the *fourth* satellite and not to the first as described. The three dark spots seen were really the shadows of the first and second satellite and the fourth satellite itself. The first satellite was also projected on the disk of Jupiter at the time of the observation, but it was not seen under the form of a dark spot. The error in the original description arose from a mistake in the identification of the satellites and their shadows, four of which were on the planet at the same time.

W. F. DENNING

Bristol, June 1

Animal Intelligence

THE instances of intelligence which I am about to relate, to the credit of a cockatoo, were described to me by the owner, a lady, in whose presence they were displayed, as well as in that of several other witnesses, one of whom (her husband) was also present on two occasions when I heard the accounts.

The bird is fond of white lump-sugar, and ordinarily drops it into his saucer of tea or other drink to soften it. On one occasion when he was thought to be thirsty, a glass of water was offered him, which appears to have been of the goblet kind, about 6 inches high, with a foot and stem, and holding, it would seem, something more than a large wine-glass and less than a small tumbler. Shortly after, the bird received a piece of sugar, and, as usual, dropped it into the water. But now, alas! the depth of liquid was too great for him to recover the saturated lump; and unfortunately, not having myself witnessed the occurrence, I am unable to describe the indications of mental effort which doubtless preceded the attempt to solve the problem of extracting the lump of sugar before it should disappear. I was told that the like difficulty recurred next day, and, whether on account of the practical failure of the first attempt, or in consequence of a fresh inspiration at the moment, a different *and entirely successful* plan was then adopted. It is no doubt to be regretted that the experiment was not followed up, but the reason will shortly be apparent. Now, as to the first attempt. There was no endeavour to upset the glass; it was too high for the claw to be used, and too deep for the beak to be plunged in. To *drink* all the water would indeed have been, as remarked by the narrator, "an heroic remedy." What "Koko" *did* do was to *bale* the water out with his scoop-like lower mandible. Here again I find myself unable to describe the action more exactly, but it must have been in the highest degree interesting to watch the operation, with its increasing difficulty, and constantly diminishing prize at the bottom. Finally we may suppose that the sugar having disappeared the last portions were at least partly enjoyed. Still the result was to some extent evidently a disappointment; for on the next occasion "Koko," without the least hesitation, put in practice a device which we may fairly suppose he had thought out meanwhile. He began forthwith to drop in lumps of sugar one after another until the last was level with the surface, when he recovered that one and left the rest to their natural fate, while he peacefully enjoyed the fruits of his invention.

I have unfortunately too slight an acquaintance with the ways of these birds to know certainly whether this is above the average of their intelligent acts and as such worthy of space in your columns. For the same reason I hesitate to give, at second hand, other indications which, however interesting to me, might prove less so to others. I will only add that it is so distressing to see so nice a creature almost naked, through its inveterate propensity to pluck out every feather within reach, that I should be glad to hear of any possible remedy.

J. HERSCHEL

23, Suffolk Street, Pall Mall East, S.W.

P.S.—At the suggestion of a gentleman whose name is well

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known to readers of NATURE in connection with animal intelligence, a proof of the above letter was sent to the bird's headquarters for confirmation. Although I cannot now regret that all these interesting details have been thus elicited, most readers will agree with me in wishing that the first account had been also written in M. d'Abbadie's characteristic style. However that may be, I am sure that I shall only be expressing the wishes of every reader as well as my own in taking this opportunity of thanking him cordially for his amusing and interesting response to my appeal for corroboration.—J. H.

[The following is M. d'Abbadie's letter :—]

MY DEAR SIR,—I have met few people who can pen a narrative quite accurately as you have done. Were I writing history, I should add that "Koko" (a *Cacatua moluccensis*) seems to hail with satisfaction the appearance of a coffee-tray. As soon as it is laid on the table he lifts by its central knob the sugar bowl's cover, picks up a lump of sugar, and drops it in an empty cup, on which he taps with his beak to intimate that he is thirsty, for dry sweets are not to his taste.

This bird is the wonder and plague of my life. One day curiosity (?) impelled him to pull into shreds my only kaleidoscope. He got for his industry a few touches of a whip, which he tore to pieces twenty-four hours later, showing apparently that memory is one of his gifts. He has a knack of tearing my pens and papers, sometimes with good reason. As, however, I arrogate those privileges to myself, "Koko" is excluded from my study. Its door, partly glazed, has a pad to prevent draughts, and, before I added a bolt, was closed only by a knob two centimetres thick. Climbing along the pad eighty centimetres above the floor, he looked slily with one eye through the glass, and if the coast was clear he then proceeded to business by turning the knob with his powerful beak and then pulling it, while one claw pushed against the doorpost, the other holding on to the pad. Another door has a lock, and servants thought to exclude the intruder by turning the key, but "Koko" soon learnt to turn it back before applying his energies to the knob. Having thus put the door ajar, he descends cautiously with beak and claws along the pad, opens the door by a push or pull of his beak, as the case may be, and, stopping on the threshold, exclaims modestly, "Koko!" like a Wolseley or a Graham announcing his recent victory.

I say *modestly*, for this bird assumes often a haughty tone when uttering what we call his public speech. It is a rambling gabble, and, like the sayings of a French orator who shall be nameless, it is wholly unintelligible. However, its varying tones are splendid. Those of indignation and command prevail, but in the course of seeming argument "Koko" expresses also and most forcibly concession, interrogation, pity, disdain, ridicule, contradiction, and even logical inference. Without having read the Roman author who advises orators to take hold of their beards when pausing to reflect, "Koko" halts now and then his wordy torrent to seize his chin with his claw, as if pondering on the best line of action. Other appropriate gestures add to the seeming reality of his discourse. I have seen him stand suddenly on one leg, double up the other claw like a fist, and deal a blow on the air as if to knock down an enemy. In spite of their wide sleeves, our barristers might well envy the fulness of gesture imparted by his wings. He raises them expanded over his head, then throws them down impetuously before himself with a seemingly clenching argument. I have heard that Burke used his arms in the same way when beginning his outbursts of eloquence.

The wisdom of nations has sometimes found it necessary to put even statesmen in durance vile, and "Koko" has not escaped the lot of his betters. As, however, he contrived to unfasten several kinds of common spring padlocks, and even one which requires, like my door, three simultaneous manœuvres, my astronomical artist boasted of making one which would puzzle even a Christian. Our bird was chained with this ingenious invention, and immediately busied himself for about two hours pressing on every side the brazen problem. It seemed to cause a heavy expense of thought for his slender brains. On the following day he opened this new-fangled padlock, but with evident difficulty. Finally, having mastered it the third morning, he then freed himself with the greatest ease. Withal he cannot ged rid of a padlock that requires a key, nor has he yet pushed back a loose bolt on the very door where he overcomes a fastening apparently more complicated. May we infer that bird reason differs from human reason?

Although he has not been in a theatre, "Koko" whistles when displeased. He can laugh, bark, and cackle. Two first-rate players at fives laid a wager that they would be the gainers in my private court, even with their feet tied together. This forced them to jump in order to meet the ball, and their eagerness brought on several falls, some dozens of witnesses laughing at each mishap. "Koko" had always inspected the fives games from his favourite perch on a neighbouring balcony. He now wished perhaps to improve an incident new to his experience. Having alighted in the court, he proceeded to stand on one foot, then jumped, falling each time sometimes forwards, sometimes sideways, like the players, and took good care to laugh loudly at each pretended stumble.

The foregoing facts, where a bird's reasoning powers seem to rival those of men, suggest two questions: (1) Where is the boundary between them? and (2) whether intelligence depends, as is often supposed, merely on size of brain? Unable to answer these queries, I remain very truly yours,

ANTOINE D'ABBADIE,
de l'Institut de France

Paris, May 20, 1884

METEOROLOGY IN VICTORIA

THE monthly and other publications on meteorology and terrestrial magnetism issued by the Melbourne Observatory continue to be regularly received by us, the last *Monthly Record* being for December 1883. Since we reviewed these *Records* (NATURE, vol. xiv. p. 153) we have observed with much interest the steady, and latterly the rapid, extension of climatological stations over the colony. During the ten years ending December 1883, while the number of fully equipped stations has remained nearly the same, stations at which temperature is observed have increased from 10 to 27, and stations for rain observations from 34 to 170. These 170 stations are conveniently classed into coast, watershed, and river-basin groups, and the individual gauges of each group are further arranged in the tabular returns in the order of their heights, which rise to about 4000 feet. The *Records* conclude with a detailed report for all the stations of thunderstorms, hail, snow, frost, gales, hot winds, auroras, earthquakes, &c., observed during the month.

While isobars can be drawn with tolerable correctness from the observations of a small number of stations, and isothermals from the returns of a few more, but still a comparatively small number of stations, it cannot be too strongly insisted on that a very large number of rain-gauges are required to give even a tolerable approximation to the actual rainfall of a country for a definite period, say, a week or a month, which may not seriously mislead those interested in the rise and fall of prices of agricultural and other products that depend on the weather. The meteorological authorities of South Australia and New South Wales are, equally with Mr. Ellery, so fully alive to the paramount importance of an adequate observation of the rainfall, that after a few years' continued vigorous effort this large portion of Australia will take rank, in respect of its rainfall, as one of the best observed regions of the globe.

At Melbourne the wind is observed and the results are discussed with admirable fulness. In summer the prevailing winds are southerly, and in winter northerly. The strongest winds are north and north-west, and the lightest east and south-east, the south-easterly winds in some seasons blowing with only about a third of the velocity of the north-westerly winds. The diurnal velocity of the wind falls to the minimum from about midnight to 4 a.m., and rises to the maximum from about 10 a.m. to 4 p.m. As regards season, the absolute maximum occurs at noon in winter, but in summer two hours later. Another important feature in the diurnal velocity of the wind is that from April to August the daily maximum is only a half more than the minimum velocity, whereas from October to February it is more than double. In other words, the maximum velocity rises to a greater extent above the daily mean during the period of the year when the temperature

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